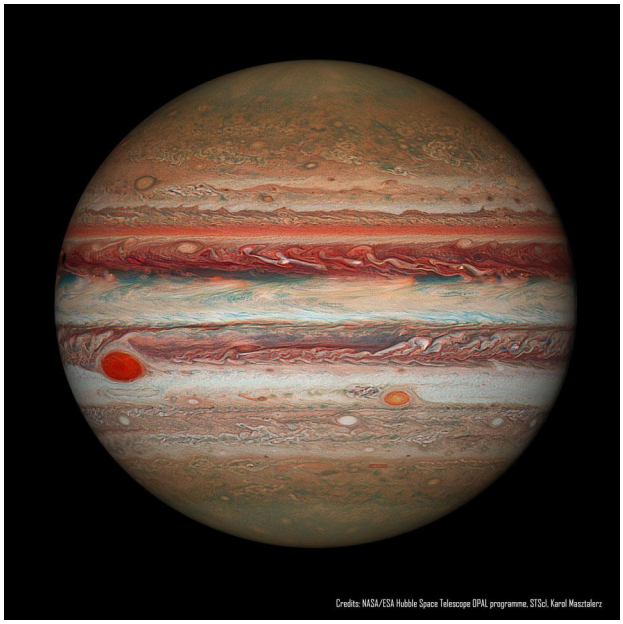
Planet Deformation



This activity will demonstrate how some planets are actually oblate spheroids due to the effects of angular momentum.

Number of Participants: 5-7 people

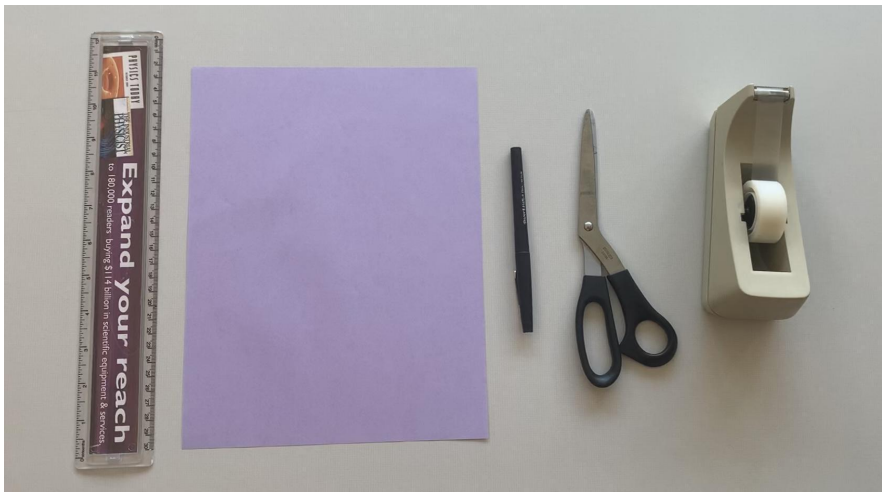
Audience: General Public

Duration: 2-4 minutes

Difficulty: Level 2

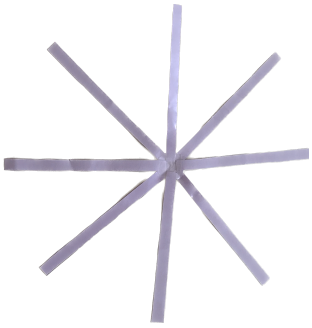
Materials Required:

- dowel rod
    - length: 18 inches
    - diameter: ⅜ inches
- cardstock or paper (8.5 in. x 11in.)
- scissors
- ruler
- glue or scotch tape
- drawing compass (optional)



Setup:

Building Your Planet



1. Draw and cut out 2 circles with a diameter of 4 cm.
2. Cut out a circle out of the center of the first disk so it fits tightly around the dowel rod. Cut out a circle out of the center of the second disk so it fits loosely around the dowel rod.
3. Cut 8 rectangular strips (1.25 cm x 30 cm). Glue or tape them to disk 1 so they go all the way around the disk. It will look like a spider.

4. Glue or tape the ends of the rectangular strips to disk two so it forms a planet!
5. Then slide the newly formed planet onto the dowel rod.
6. Holding the dowel rod, spin it between your hands and watch what happens!

Presenter Brief:

The presenter should know that the Earth spins because the solar system was formed from a spinning accretion disk around the Sun. They should also understand how angular momentum affects the shape of objects.

Vocabulary:

- Angular Momentum: the quantity of rotation of an object; $L = p \cdot r$
    - an object that is rotating wants to keep rotating
- Momentum: the quantity of motion that an object has; $p = m \cdot v$
    - an object that is moving wants to keep moving

Physics & Explanation:

Middle (ages 11-13) and general public:

👈 The Earth isn't perfectly round because it spins. The rotation causes materials to flow similar to a liquid!

Ask: What shape is the Earth?

Expected answer: A sphere!

While the Earth looks very spherical, it is in fact not exactly a sphere. Due to the speed of the Earth's rotation (how fast it's spinning), the Earth bulges 0.3% at the equator. Jupiter bulges 7% at its equator because a day on Jupiter is only 10 hours and can be seen at the top of the document. When the solar system formed, it started off as a cloud. As gravity pulled in the cloud dust, it formed planets and those spun faster and faster. The Earth started spinning due to the formation of the solar system from an accretion disk around the Sun. When the Earth formed, a day on Earth used to be ~19 hours instead of our 24 hours because it was spinning so fast. As the solar system aged, the Earth's rotation slowed down. It's slowing down because of the tides caused by the Sun and moon.

👈 Angular momentum pulls mass towards the equator (center).

As the Earth spins, it flattens at the poles and bulges at the equator. This is due to angular momentum counteracting the gravitational force. The Earth spins faster at the equator then it does at the poles, this increases the amount of angular momentum at the equator. This increased amount of angular momentum pulls more mass towards the equator.

Think about when people make pizza from scratch. The person starts with a ball of dough but when they throw the dough they add a spin. As the dough spins, it flats out becoming our beautiful pizza crust.

Additional Resources:

- Rotational Motion: Crash Course Physics #11: an in depth explanation of angular momentum
- Why Are Planets Almost Spherical? | HowStuffWorks
- https://youtu.be/Zjqrx7wrpJc

Important Variables:

L: angular momentum of an object

p: momentum of an object

r: radius

Appendix Table of Contents:

Credit: https://www.freepik.com/free-vector/spinning-globe-isolated-vector_30700055.htm

Modified by: Emily Pavasars

Appendix A: Angular Momentum Figure